

Csaba Tóth, Lawrence Berkeley National Laboratory

Bio

Csaba Tóth is a staff scientist and operations coordinator in the BELLA Center at Lawrence Berkeley National Laboratory (which he joined in 2000). His research interests include high intensity light-matter interactions involving high peak power, ultrashort laser pulses; multiphoton processes; optical tunneling; higher-order optical harmonic generation; the development of new X-ray and soft X-ray sources; and their application for imaging and time-resolved diffraction and absorption. He has more than 30 years of experience in the field of generation and measurement techniques of ultrashort light pulses in the nano-, pico-, femto- and attosecond time scales. Since 2000 his research has been focused on laser-plasma interactions, acceleration of electrons and other charged particles by high power laser pulses and plasma waves, and on the design and development of multi-terawatt chirped pulse amplification (CPA) laser systems. Recently he has been involved in the design, commissioning and operation of the BELLA Laser, a PW, 1 Hz laser system at LBNL.

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Abstract

The Berkeley Lab Laser Accelerator (BELLA): Commissioning and Safety Systems of a PW-class 1 Hz Laser (Csaba Tóth*, Nathan Ybarrolaza, Patrick Bong, and Wim P. Leemans)

Design, construction, commissioning and operational details of the Berkeley Lab Laser Accelerator (BELLA) will be reviewed, with special emphasis of the appropriate laser and radiation safety systems. The BELLA laser and the Laser Plasma Accelerator (LPA) research facility were designed and built from 2009-2012 and operates for plasma physics and electron acceleration experiments in the Lawrence Berkeley National Laboratory (LBNL) since Spring of 2013. The laser provides >40 J energy in <40 fs compressed pulses at Petawatt peak power and at 1 Hz repetition rate. It is based on a double Chirped Pulse Amplification (CPA) configuration, including a FrontEnd providing 1.5 J energy at 10 Hz, and two subsequent Ti:sapphire amplifiers pumped by respectively 4 and 8 new high energy flashlamp-pumped, frequency doubled Nd:YAG lasers (Gaia HP) developed by THALES Optronique. The pump lasers deliver 14 J energy per pulse at 1 Hz at 532 nm. The laser system has been integrated in LBNL's PLC-based equipment and personnel protection systems and with the experimental area target systems, including a post-focus high power single shot diagnostic suite.

The laser and accelerator commissioning process involved a series of technical and operational reviews; the facility now routinely provides high quality focused laser pulses (controllable focal spot distribution, exceptional beam pointing stability, shot-to-shot energy and pulse duration stability) enabling high precision experiments, including the use of capillary discharge based LPAs. Experiments on demonstrating the capability of generating 10 GeV class accelerated electron beams from an LPA are in progress.